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AUTHOR Frederiksen, John R.
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ABSTRACT

A major purpose of the Search for Effective Schools Project has been to explore the truth of the following two propositions: that both pupil response to instruction and the delivery of instruction are functions of pupil background, prior knowledge and level of achievement. That is, the project sought to demonstrate the existence of effective schools in which teachers succeed in imparting the basic skills of reading and mathematics to both poor and non-poor children. One goal was to locate variables that describe the educational resources offered by a pupil's family, and that in the case of some schools, appear to limit their educational effectiveness in teaching the basic skills. Using the Michigan Educational Assessment Program tests, administered to 4th and 7th grade pupils, each background variable was separately used as a pupil classifier. The pupils were then divided into five levels on the basis of mother's and father's education. It was found that effective urban schools do exist, and achieve high levels of performance in reading and mathematics for all children they enroll, including those from educationally disadvantaged backgrounds. (Author/GSK)

Models for Determining School Effectiveness

John R. Frederiksen

Bolt Beranek and Newman, Inc.

and

Harvard University

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Models for Determining School Effectiveness

John R. Frederiksen

At the inception of the research project on which I shall report, it could be said that the prevailing belief among educators regarding effectiveness of schools for educating children of the poor was one of extreme pessimism. Against the obstacle of an impoverished family background (associated in our society with social class, economic status, and race), schools could not be expected to achieve equality in educational outcome with those typical for children of the middle class. Nor was this view without a research foundation. Studies carried out by Coleman and his colleagues (1966), by Jencks (1972), and by the IEA (Thorndike, 1973), and re-analyses of the problem by Mayeske et al (1973) and by Mosteller and Moynihan (1972) all supported to some degree the above pessimistic conclusion.

And yet, curiously, two other propositions were receiving support in other bodies of research, and in those propositions lay the seeds for a conceptual and methodological rebuttal to the thesis of school ineffectiveness. What are those propositions?

1. <u>Pupil response to instruction is a function of pupil background, prior knowledge and level of achievement</u>. Instruction that is effective with one child, may be ineffective with another. The large body of research on aptitude-treatment interactions (ATI's) that has been summarized by Cronbach and Snow (1977) is adequate testiment to the truth of this proposition. When applied to the effects of schools it leads to

the expectation of an interaction between family/social background of pupils and effects of school/teacher--an interaction that has been largely ignored in the school effects literature.

2. Delivery of instruction is a function of pupil background, prior knowledge and level of achievement. This second source of interaction has at least two sources: First, a well-motivated individualized program of instruction that sets different learning objectives for different individuals can have the effect of denying pupils from "disadvantaged" backgrounds instruction routinely given pupils from "middle-class" backgrounds. Second, school response to background and social class may involve attitudes and expectations that have an effect on pupil performance over and above any limits placed on school learning by educational background and social class.

A major purpose of the Search for Effective Schools Project has been to explore the truth of these two propositions as they apply to the questions. What are the limits on educational achievement of "poor" children? And, what is the standard of achievement that can reasonably be expected of urban schools when working with this population of pupils? Put another way, we sought to demonstrate the existence, even given the current "state-of-the-art" of urban education, of effective schools in which teachers succeed in imparting the basic skills of reading and mathematics to both poor and non-poor children. Our standard of evidence for this success lies in demonstrating that such schools achieve comparably high levels of performance for these two groups of children on standard tests of reading

and mathematics. Our research design and methods of analysis allowed us to explore interactions between school effectiveness and pupil background, which I have shown to be present, in an earlier reanalysis of the Coleman data (Frederiksen, 1975).

The identification of instructionally effective and ineffective schools is based upon results of an extensive series of data analyses carried out on pupil performance and family background data obtained for 11,368 pupils, drawn from six cohorts of pupils in the Lansing, Michigan School District. The objective of this phase of study was to identify schools that are instructionally effective in teaching disadvantaged children, and other schools that are instructionally ineffective. This second set of schools is further subdivided into a class of schools that are generally ineffective, and schools that are differentially effective. The former schools are those that are ineffective in teaching all pupils, regardless of their status with respect to family background character, while schools in the latter group are demonstrably ineffective only in teaching children coming from educationally disadvantaged families. The demonstration of the existence of these three distinct groups of schools and the development of methods for the classification of particular schools into each of these three groups has been the result of our analyses of Lansing data, carried out with the support of the Carnegie Corporation. I shall present here a summary account of the methods we have used, along with some of our principle results.

Methods and Results

The general goal of the Search for Effective Schools Project has been to locate variables that describe the educational resources offered by a pupil's family, and that in the case of some schools appear to limit their educational effectiveness in teaching the basic skills of reading and math. The family background variables we have considered in our analyses are listed in Table 1. Variables 1 - 10 are descriptive of the individual pupil's family, and were obtained from individual pupil files or from centralized sources in the Lansing school department. Variables 11 - 18 were obtained using the Census 3rd Count (1970) from pupil's street addresses; they are descriptive of their residential block.

Using Michigan Educational Assessment Program (MEAP) tests administered in the fall of a pupil's 4th and/or 7th grade year, each background variable was separately used as a pupil classifier in a series of one-way Multivariate Analyses of Variance (MANOVAs) with (a) 4th grade reading and math, (b) 7th grade reading and math, or (c) 4th and 7th grade reading and math scores as performance criteria. The results of these analyses are summarized in Table 2. In general, individual background variables are more strongly related to pupil performance than are census-derived variables, with the most important being mother's and father's education, father's occupation, and race. The most important census variable was found to be value of owner-occupied housing units. Mean performance measures for each of these variables are shown in Figures 1 - 5.

A second question to be settled prior to selecting variables for use in school analyses was the degree and nature of redundancy among the background variables. An iterative least-squares factor analysis of intercorrelations among background variables yielded four oblique common factors, shown in Table 3. The factors were termed: I. Education/Social Status, II. Neighborhood Character (Single Family, Owner-Occupied vs. Multi-family, Rental Units), III. Neighborhood Value/Income Level, and IV. Race. When these variables were used together as pupil classification factors in a MANOVA, only the factors of Race and Education proved consistently predictive of school achievement in the 4th and 7th grades. Accordingly, we selected Parents' Education as our primary background variable, with Race and Neighborhood Value (our best census-based background factor) as optional covariates in some analyses.

Pupils in the Lansing schools were then divided into five levels on the basis of Mother's and Father's Education. Pupils in the bottom stratum, for example, came from families in which neither parent had completed high school. Descriptions of educational patterns typical of parents representing each stratum are given in Table 4. In our analyses of school effectiveness, pupils were always subdivided into these five levels of educational advantage or disadvantage.

Our primary analysis, which supported the division of schools into the three subgroups of Effective, Generally Ineffective, and Differentially Effective Schools, consisted of a two-way

MANOVA. The two factors were Schools (S) and Education of Parents (E), with the first factor represented by 38 schools, and the second by 5 levels of education. The dependent variables were 4th grade Math and Reading scores. The results are summarized in Table 5.* There were significant effects of School Attended and Education of Parents, and there was also a significant interaction between the two factors. When covariates were introduced to adjust for any residual differences in pupil performance due to Race that were <u>not</u> predictable from Educational Status, there were no changes in the magnitude of either school effects or school by background interactions. Introduction of two other covariates in neither case altered this picture.

In our original analysis, pupils were retained if they had been enrolled in a school in the criterion year (3rd grade) and in at least <u>one</u> previous year (2nd or 1st grade). When alternative mobility criteria were employed (see Table 6) there were slight increases in the magnitude of school effects and school by background interactions as increasingly severe criteria were introduced. However, these changes were relatively minor in degree.

Figure 6 illustrates the extent to which educationally effective schools succeed in achieving parity in the performance of the most educationally disadvantaged pupils (stratum 1) with

* The table gives the canonical correlation (R) and probability (P) associated with each effect. R is a measure of the degree to which pupil performance is predictable from a factor. P gives the statistical reliability of the effect.

performance typical of middle class, non-deprived pupils. The figure shows the distribution of school means on the MEAP reading test, obtained by the most disadvantaged stratum of pupils. The pointers indicate the level of performance typical of pupils whose fathers' completed college, attended college, or completed high school. Between 4 and 10 schools can be said to be achieving a level of performance for this most disadvantaged of our subgroups that is near or above the educational norm represented by pupils whose parents have completed a high school education. A similar result was obtained when math scores were considered.

The nature of the interaction between parents' educational background and school effectiveness in teaching reading and math is illustrated in a plot called a school effectiveness graph, shown in Figures 7 and 8. In Figure 7, the mean number of reading objectives for disadvantaged pupils (subgroups 1 & 2) is plotted on the abcissa. The average performance level for middle class pupils (those in subgroups 3 - 5) is plotted on the ordinate. The points in the figure represent individual schools. The distance of a point above the diagonal line gives us an indication of how discriminatory a school is in failing to achieve parity in performance between disadvantaged pupils and middle class pupils. Note that if there were no interactions between school and background effects, all of the points should fall on a straight line parallel to the diagonal. It is clear that this is not the case. The unusually effective schools appear to be non-discriminatory: while they succeed in developing reading

skills of educationally deprived pupils to levels typical of non-deprived pupils, they also are generally among the best schools with respect to their effectiveness for the more advantaged subgroups. In contrast, the <u>ineffective</u> schools--those that are failing to develop acceptable reading skills in educationally disadvantaged pupils--vary widely in the generality of their effectiveness: Some appear to be <u>generally</u> ineffective for all subclasses of pupils, while others appear to be differentially effective, in that they are effective for middle class pupils but not for the less advantaged children. We take the third quartile on the abcissa (Q_3) as the cutting point for designating a school as effective in teaching the educationally disadvantaged sub-population, and the first quartile (Q_1) as the cutting point for classifying a school as ineffective for this subpopulation. And further, we take the first quartile (Q_1) on the ordinate as the boundary point separating ineffective from average (within $Q_1 - Q_3$) or above-average (Q_3 and above) schools in terms of the performance of the non-disadvantaged population. Using these criteria, we find (I) 10 schools that are effective in teaching reading to educationally disadvantaged children and, at the same time, average or above average in their effectiveness for middle class children; (II) 2 schools that are generally ineffective in the teaching of reading to educationally disadvantaged children, as well as to the other strata of the pupil population; and (III) 7 schools that are differentially effective in teaching of reading to middle class but not to disadvantaged children.

We find that a similar situation arises in the analysis of math scores (Figure 8). Furthermore, the classification of schools' effectiveness on the basis of math scores is similar to that for reading scores. This can be seen quite clearly if you compare, for example, ID numbers of schools in the effective category for reading with those for mathematics. The majority of the schools remain in the same region of the School Effectiveness Graph, i.e., in the upper right-hand corner.

As a by-product in each of our MANOVAs, discriminant functions are calculated which tell us how optimally to weight reading and math scores in classifying schools as effective or ineffective. The weights in the discriminant function show that, while reading and math both receive positive weights (.69 and .39, respectively), we should favor the reading test scores in classifying schools as instructionally effective or ineffective.

We have carried out a series of subsidiary analyses designed to explore how robust is the classification of schools as we vary the basis of the classification. As an example, I have already mentioned that we introduced an additional control for race, by employing as a covariate that variation in race within schools that is not associated with educational status of parents. In Figure 9, I have plotted the performance for the most disadvantaged subgroup of pupils for each of the two analyses: the ordinate values are those obtained with an adjustment for race, the abcissa values are those for our original analysis in which there was no such adjustment. It is clear

that consideration of race as a variable influencing the classification of school effectiveness is unnecessary.

In another series of analyses, we studied the magnitude of school effects as we varied the grade whose performance formed the basis for the evaluation. As expected, the size of school effects increased with length of time spent in school: canonical R's (a measure of the predictability of performance in Stanford Achievement test (SAT) reading and math scores from knowledge of a child's school of attendance) were .27 for grade 1, .30 for grade 2, .32 for grades 3 and 4, .35 for grade 5, and .38 for grade 6.

Our classification of schools' effectiveness did not depend to any important degree on the particular test used in measuring pupil performance. When we compared the results for the SAT (reading and math) administered in the spring of the third grade (i.e., at the end of an instructional year) with those for the Michigan assessment instruments administered in the fall of the fourth grade, there was little difference in outcome. In either case, the size of school effects and school-by-background interactions were comparable. Separate analyses of school effects were also carried out for two discrete time periods, 1971-75, and 1976-77. Our interest was in how stable were the classifications of schools for the two time periods indicated. And again, the identification of effective schools was strikingly similar. Of the 10 most effective schools in 1976-77, 6 were also as effective in the earlier time period, and the remaining 4 were

borderline effective schools, falling less than one test unit (reading objective) below the Q_3 cutting point used in the classification.

One final analysis is worthy of mention here. Critics might argue that schools that are effective happen to have enrolled "brighter" or more able pupils than those in less effective schools. To examine this possibility (which we consider unlikely due to the control for pupil family background), we calculated for each pupil an average growth rate for the four-year period from grade 1 to grade 4. The average growth in reading and in mathematics achievement became the dependant variable in a MANOVA which was otherwise similar to those we carried out on cross-sectional data. The results were again clear-cut. School effects were significant with a canonical R of .34, and School-by-Background Interaction received here a canonical R of .32, although it was not in this case statistically significant. Again the classification of schools that are effective was similar to that based upon cross-sectional performance data. Thus, we conclude that the effects we are observing represent the effectiveness of instruction, rather than a limitation in educability due to learning ability.

Conclusions

Our conclusion is that, even given the present state-of-the art in urban education, effective schools exist--and in not inconsiderable numbers. These schools achieve high levels of performance in reading and math for all children they enroll, including

children from educationally disadvantaged backgrounds. The level of performance that is achieved with this group of pupils is at or above the performance level typically reached by middle-class children in the same school district. We conclude further that the reason that past studies of school effects have so underestimated the effects of schooling lies in inappropriate research designs, which made no allowance for the interaction between background and school effects which we have documented. In our continuing work in the Search for Effective Schools Project, we are gathering further substantive data which we expect will support our contention that effective schooling can and should be made available to all our children.

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Table 1

BACKGROUND VARIABLES *

Variable Name	Description (Coding)	Source
1. Race	1=Black 2=Spanish 3=White	RAMS File
2. Guardian	1=Mother Only 2=Natural Mother & Stepfather 3=Both Natural Parents	RAMS File
3. Working Parents	1=None 2=Mother 3=Father 4=Mother and Father	CA60 Folders
4. Mother's Education 5. Father's Education	1=Eighth Grade or less 2=Grades 9 - 11 3=Completed High School 4=Attended College 5=Completed College 6=Post-graduate Work	CA60 Folder
6. Mother's Occupation	1=Unskilled Employee 2=Machine Operators & Semi-skilled Employees 3=No Job 4=Skilled Manual Employees 5=Technicians & Clerical & Sales Workers 6=Semi-professionals; Small Businessmen 7=Lesser Professionals; Medium Business Owner 8=Major Professionals; Large Business Owner & Higher-Level Executive	CA60 Folder
7. Father's Occupation	1=No Job 2=Unskilled Employee 3=Machine Operators & Semi-skilled Employees 4=Skilled Manual Employees 5=Technicians& Clerical & Sales Workers 6=Semi-professionals; Small Businessmen 7=Lesser Professionals; Medium Business Owner 8=Major Professionals; Large Business Owner & Higher-Level Executives	CA60 Folder

Variable Name	Description(Coding)	Source
8. Number of Siblings *	Number of siblings in family (REFLECTED by subtracting from 10)	CA60 Folders
9. Birth Order *	Position in Order of Birth (REFLECTED by subtracting from 10)	CA60 Folders
10. Bilingual Code	Language in Home: 1=Spanish 2=English 3=Other	RAMS File
11. Density: Crowding *	Average Number of Persons per Room (REFLECTED by change of sign)	Census Block Statistics
12. Density: Persons	Average Number of Persons per Unit	Census Block Statistics
13. Average Number of Rooms	Average Number of Rooms per Unit	Census Block Statistics
14. Value: Owner Occupied	Average 1970 Value in Dollars of Owner-Occupied Units	Census Block Statistics
15. Rental Value	Average Monthly Contract Rent for Rental Units	Census Block Statistics
16. Percent Owner-Occupied Units	Percent of Units that are Occupied by their Owners	Census Block Statistics
17. Racial Composition of Block *	Percent Black Residents in Block (REFLECTED by subtracting from 100%)	Census Block Statistics
18. Percent Male/Female Head	Percent of Residents under 18 having families headed by Husband and Wife	Census Block Statistics

* Variables were reflected so that they correlate positively with pupil achievement in school.

Table 2

Summary of MANOVA Results:
Canonical Correlations between Background Variables and Performance Measures*

Variables	4th Grade Math & Reading		7th Grade Math & Reading		4th & 7th Gr. Math & Reading	
Background Variables						
Race	.299	(6924)	.273	(5850)	.291	(1654)
Guardian	.131	(4469)	.140	(3974)	.145	(1636)
Working Parents	.183	(6258)	.111	(5068)	.104	(1350)
Mother's Education	.317	(6491)	.332	(5088)	.326	(1491)
Father's Education	.353	(6017)	.373	(4721)	.375	(1381)
Mother's Occupation	.179	(5854)	.179	(4102)	.178	(1135)
Father's Occupation	.322	(4522)	.343	(3164)	.374	(841)
Number of Siblings	.191	(6609)	.129	(5167)	.147	(1493)
Birth Order	.127	(6513)	.091	(4782)	.142	(1396)
Bilingual Code	.090	(4531)	.083	(4025)	.093	(1654)
Census Variables						
Density: Crowding	.114	(6736)	.132	(5663)	.135	(1610)
Density: Persons	.105	(6736)	.103	(5663)	.117	(1610)
Average # of Rooms	.128	(6752)	.177	(5673)	.194	(1611)
Value: Owner Occupancy	.212	(6440)	.225	(5463)	.254	(1562)
Rental Value	.147	(3560)	.154	(2871)	.143	(823)
% Owner Occup. Units	.167	(6752)	.179	(5673)	.221	(1611)
% Racial Comp. of Block	.152	(6839)	.138	(5742)	.169	(1635)
% Male and Female Head	.168	(6801)	.152	(5711)	.194	(1625)
% Male Head	.052	(6801)	.053	(5711)	.064	(1625)
% Female Head	.148	(6801)	.121	(5711)	.178	(1625)
% Other Head	.105	(6801)	.137	(5711)	.117	(1625)

* All background effects, with the exception of 4th & 7th Grades combined for Birth Order (.009), Density:Crowding (.010), Density:Persons (.006), Rental Value (.082), & Other Head (.014), are significant with $p < .001$. Sample sizes are given in parentheses.

Table 3

Summary of Factor Analysis of Background/SES Variables:
Iterative Least-Squares Analysis of Data for Pupils in Even Groups*

Variable	Factor Loadings				Uniqueness
	I Education/ Occupational Status	II Neighborhood Character	III Value/Income Level for Block	IV Race	
Mother's Education	.705	-.048	.009	-.074	.396
Father's Education	.672	-.008	.062	-.062	.382
Father's Occupation	.600	.082	.004	.001	.437
Mother's Occupation	.435	-.038	-.012	-.024	.76[illegible]
Working Parents	.270	.106	-.106	.094	.836
Number of Siblings	.235	-.039	.005	.125	.886
Bilingual Code	.194	-.038	.027	.006	.949
Average # of Rooms	.027	.781	.051	-.214	.215
% Owner Occup. Units	-.005	.777	-.199	.074	.240
Density: Persons	-.056	.373	.225	.071	.644
Guardian	.041	.194	-.148	.135	.901
Rental Value	.033	-.213	.807	.094	.232
Value: Owner Occupancy	.128	.261	.627	-.105	.168
Density: Crowding	.047	-.024	.216	.200	.849
% Racial Comp. of Block	-.129	-.075	.053	.707	.472
Race	.098	-.074	-.055	.558	.594
% Male & Female Head	-.018	.299	.068	.325	.616

Factor	Factor Intercorrelations I	II	III	IV
I	1.000	.402	.375	.389
II	.402	1.000	.395	.376
III	.375	.395	1.000	.255
IV	.389	.376	.255	1.000

* The factor matrix was analytically rotated using the Verimax procedure; and then rotated obliquely using the Promax method with powers of 2.76, 3.44, 4.75, and 4.26 respectively for the columns of the factor matrix. The percent of variance accounted for by the 4 factors is 43.8%.

TABLE 4

Description of Typical Educational Levels of Parents for Each Stratum

Stratum	Description	%
1	Neither Parent Finished High School	20
2	One Parent Finished High School	20
3	Both Parents Finished High School	26
4	One Parent Attended College and the Other Completed High School or One Parent Completed College and the Other Attended High School	17
5	Both Parents Attended or Completed College and May Also Have Completed Post-Graduate Work	16

TABLE 5

Summary of MANOVA Results:
Factors are School (S) and Education of Parents (E)
Using 4th Grade Reading and Math as Dependent Variables

Covariate*	Effect	Order of Removal† I R	I P	II R	II P	III R	III P
None	S (Roots 1-2)	.295	.001	.206	.001	.295	.001
	(Root 2)	.146	.001	.143	.001	.146	.001
	E (Roots 1-2)	.319	.001	.376	.001	.262	.001
	(Root 2)	.053	.007	.060	.002	.061	.001
	S x E (1 Sig. Root)	.218	.031	.218	.031	.285	.001
Race	S (Roots 1-2)	.283	.001	.199	.001	.283	.001
	(Root 2)	.141	.001	.139	.001	.141	.001
	E (Roots 1-2)	.319	.001	.371	.001	.258	.001
	(Root 2)	.048	.034	.056	.007	.055	.010
	S x E (1 Sig. Root)	.228	.014	.228	.014	.297	.001
	Covariate	.225	.001	.225	.001	.225	.001
Value of Owner Occup. Units in Block	S (Roots 1-2)	.277	.001	.198	.001	.277	.001
	(Root 2)	.136	.001	.133	.001	.136	.001
	E (Roots 1-2)	.308	.001	.372	.001	.253	.001
	(Root 2)	.050	.020	.057	.005	.058	.004
	S x E (1 Sig. Root)	.228	.010	.228	.010	.291	.001
	Covariate	.017	.582	.017	.582	.017	.582
Father's Occup.	S (Roots 1-2)	.307	.001	.213	.001	.307	.001
	(Root 2)	.148	.002	.146	.003	.148	.002
	E (Roots 1-2)	.327	.001	.387	.001	.223	.001
	(Root 2)	.062	.010	.067	.005	.037	.252
	S x E (1 Sig. Root)	.261	.009	.261	.009	.357	.001
	Covariate	.009	.889	.009	.889	.009	.889

*Covariates were residual variations in Race, Neigborhood Value, and Father's Occupation, after removing by regression variance in the covariate that is predictable from Education of Parents. Thus, common variation due to Education and the variable used to form the covariate was shifted to the variable used in classifying subjects.

†Since the design was not orthogonal, three orders of removal were employed: I. S, E, SE; II. E, S, SE; III. S, SE, E.

TABLE 6

Effects of Mobility Criteria on School Effects and School by Background Interaction:
Factors are School(s) and Education of Parents(E).
Dependent Variables are 4th Grade Reading and Math.

Mobility Criterion	Effect	Order of Removal*					
		I		II		III	
		R	P	R	P	R	P
Grades 1,2 & 3	S (Roots 1-2)	.314	.001	.225	.001	.314	.001
	(Root 2)	.146	.001	.141	.001	.146	.001
	E (Roots 1-2)	.300	.001	.368	.001	.244	.001
	(Root 2)	.051	.021	.057	.008	.058	.006
	S x E (1 Sig. Root)	.226	.121	.226	.121	.285	.001
	S + S x E (Roots 1-2)	--	--	.304	.001	.404	.001
	(Root 2)	--	--	.239	.034	.237	.042
At Least Grades 2 & 3	S (Roots 1-2)	.303	.001	.212	.001	.303	.001
	(Root 2)	.146	.001	.143	.001	.146	.001
	E (Roots 1-2)	.307	.001	.369	.001	.249	.001
	(Root 2)	.054	.007	.060	.002	.059	.003
	S x E (1 Sig. Root)	.219	.058	.219	.058	.283	.001
	S + S x E (Roots 1-2)	--	--	.294	.001	.397	.001
	(Root 2)	--	--	.230	.019	.230	.019
At Least Grades 2 & 3 or Grades 1 & 3	S (Roots 1-2)	.295	.001	.206	.001	.295	.001
	(Root 2)	.146	.001	.143	.001	.146	.001
	E (Roots 1-2)	.319	.001	.376	.001	.262	.001
	(Root 2)	.053	.007	.060	.002	.061	.001
	S x E (1 Sig. Root)	.218	.031	.218	.031	.285	.001
	S + S x E (Roots 1-2)	--	--	.289	.001	.392	.001
	(Root 2)	--	--	.229	.010	.228	.010
At Least Grade 3	S (Roots 1-2)	.282	.001	.194	.001	.282	.001
	(Root 2)	.140	.001	.137	.001	.140	.001
	E (Roots 1-2)	.324	.001	.375	.001	.259	.001
	(Root 2)	.058	.001	.064	.001	.062	.001
	S x E (1 Sig. Root)	.202	.008	.202	.008	.284	.001
	S + S x E (Roots 1-2)	--	--	.273	.001	.383	.001
	(Root 2)	--	--	.219	.001	.220	.001

* Since the design was not orthogonal, three orders of removal were employed: I. S, E, SE; II. E, S, SE; III. S, SE, E.

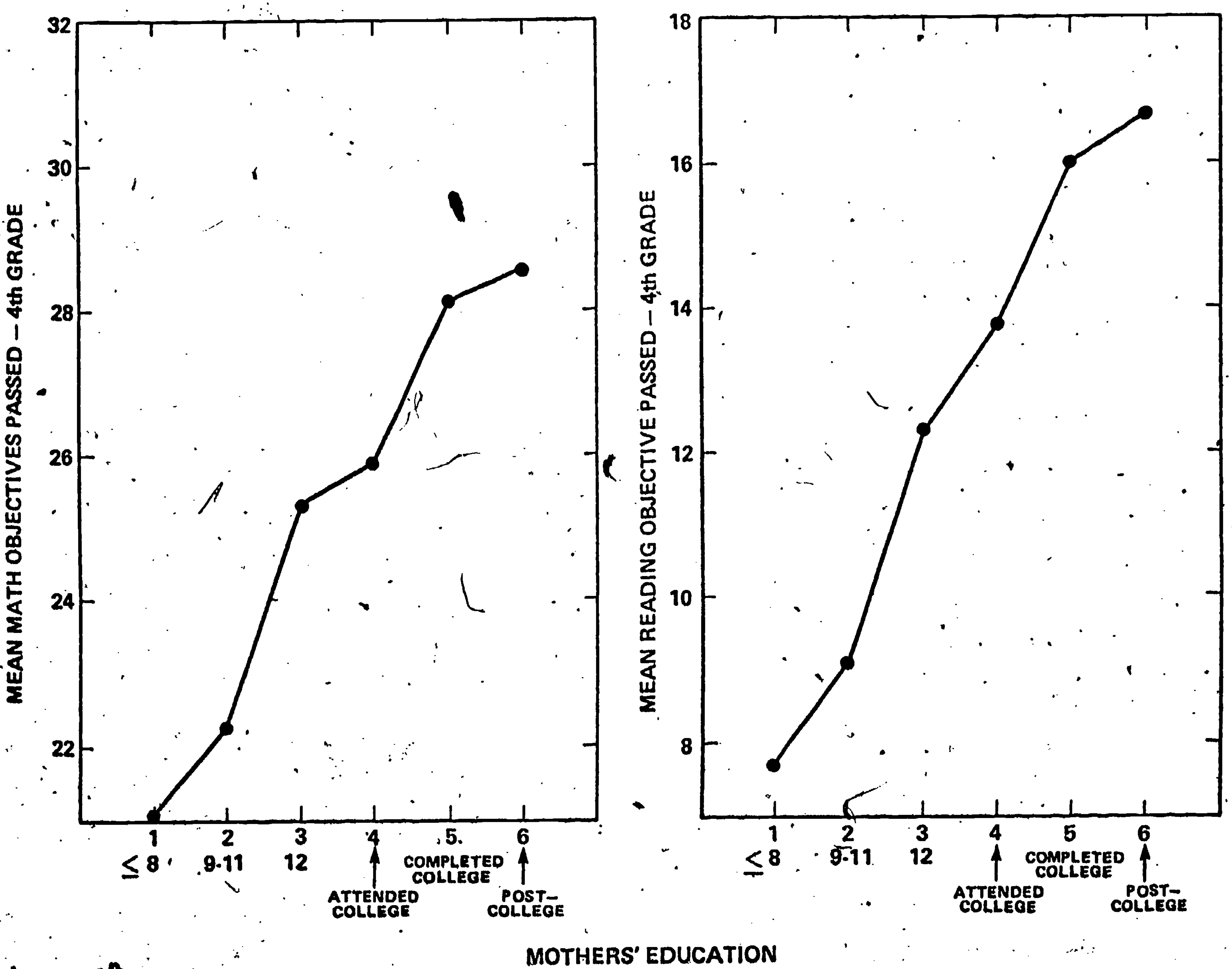

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Figure 1. Mean performance of 4th grade pupils on the MEAP math. and reading tests, plotted as a function of mother's level of education.

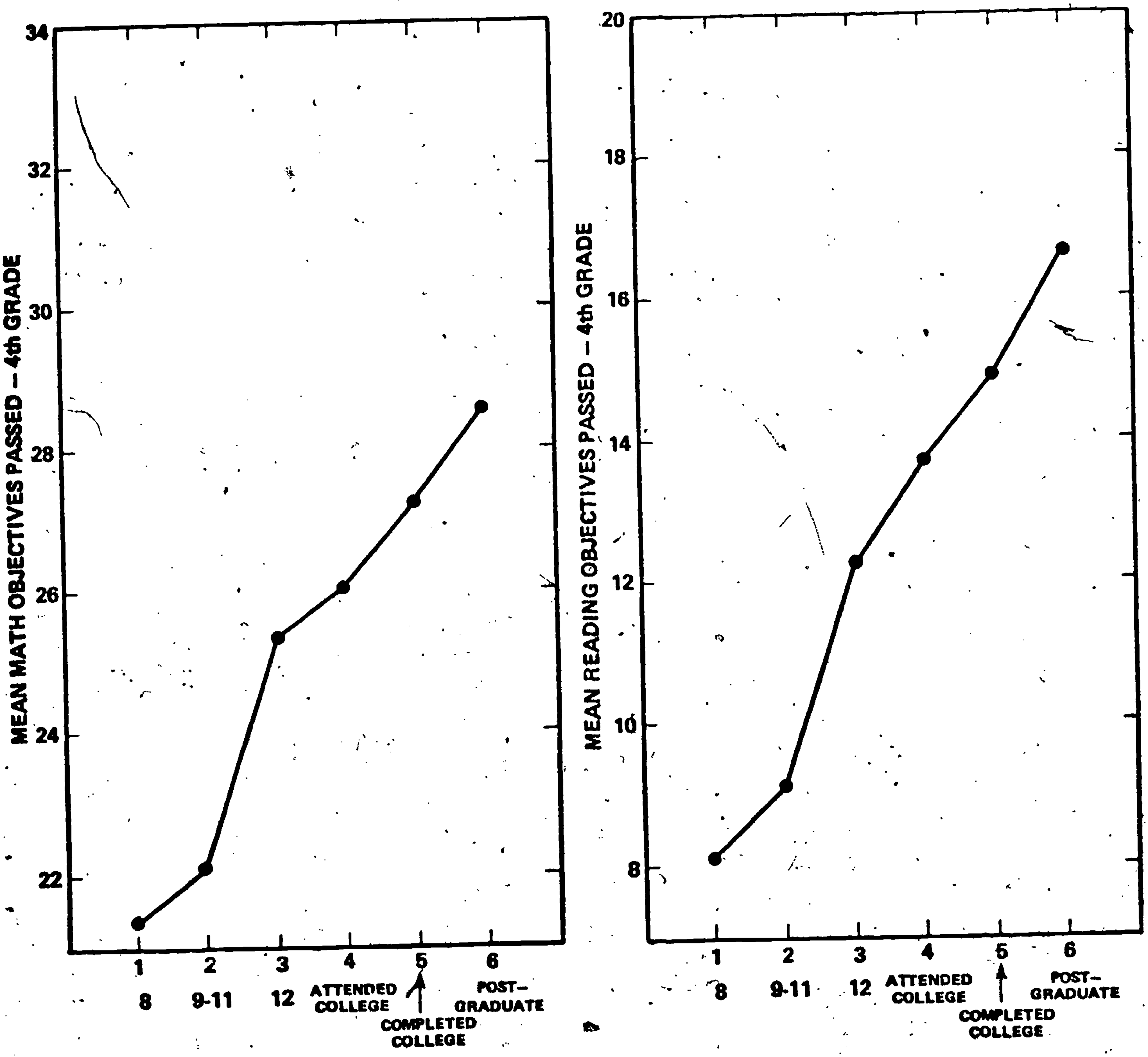

Figure 2. Mean performance of 4th grade pupils on the MEAP math. and reading tests, plotted as a function of father's level of education.

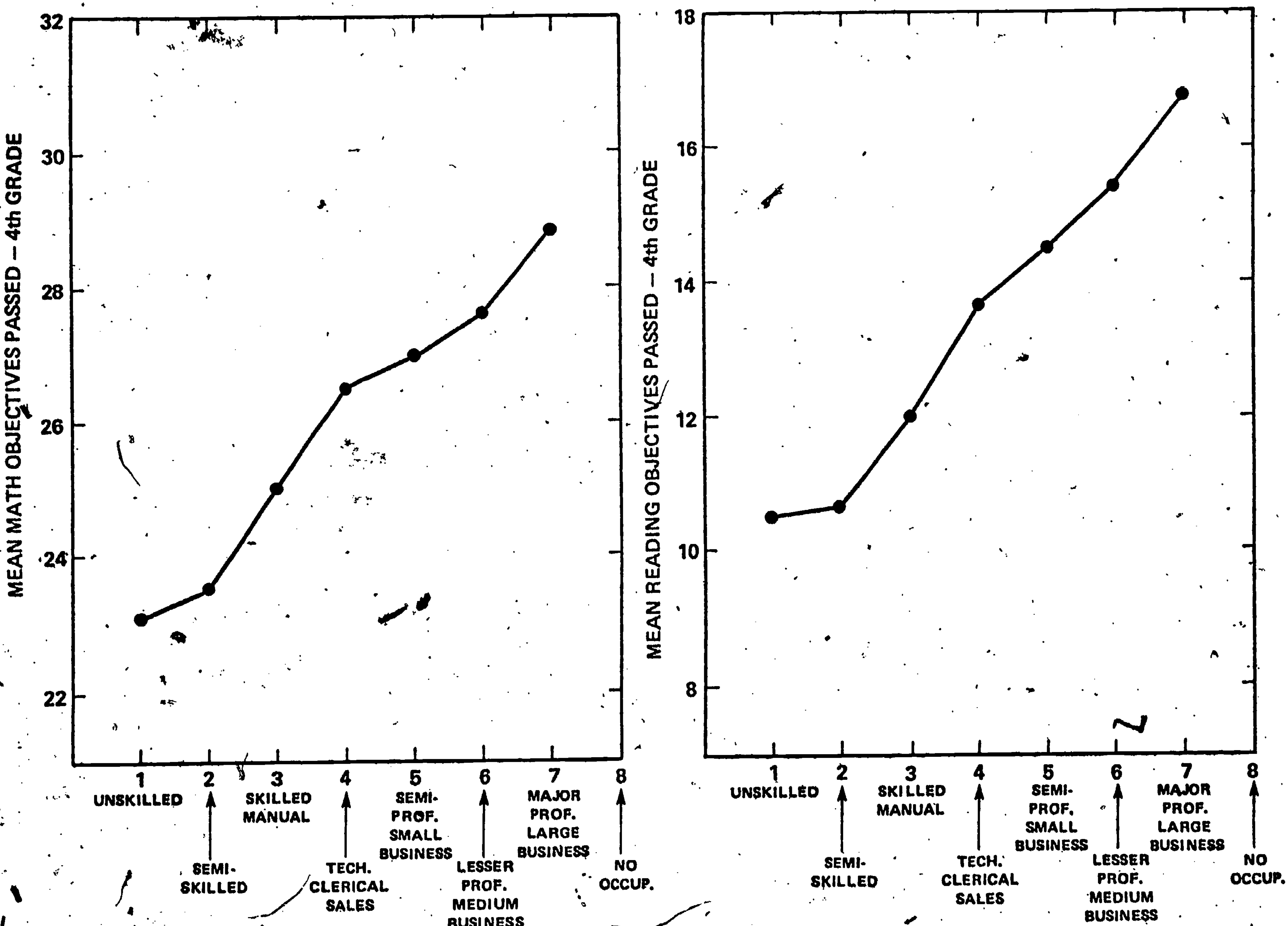

Figure 3. Mean performance of 4th grade pupils on the MEAP math. and reading tests, plotted as a function of father's occupational category.

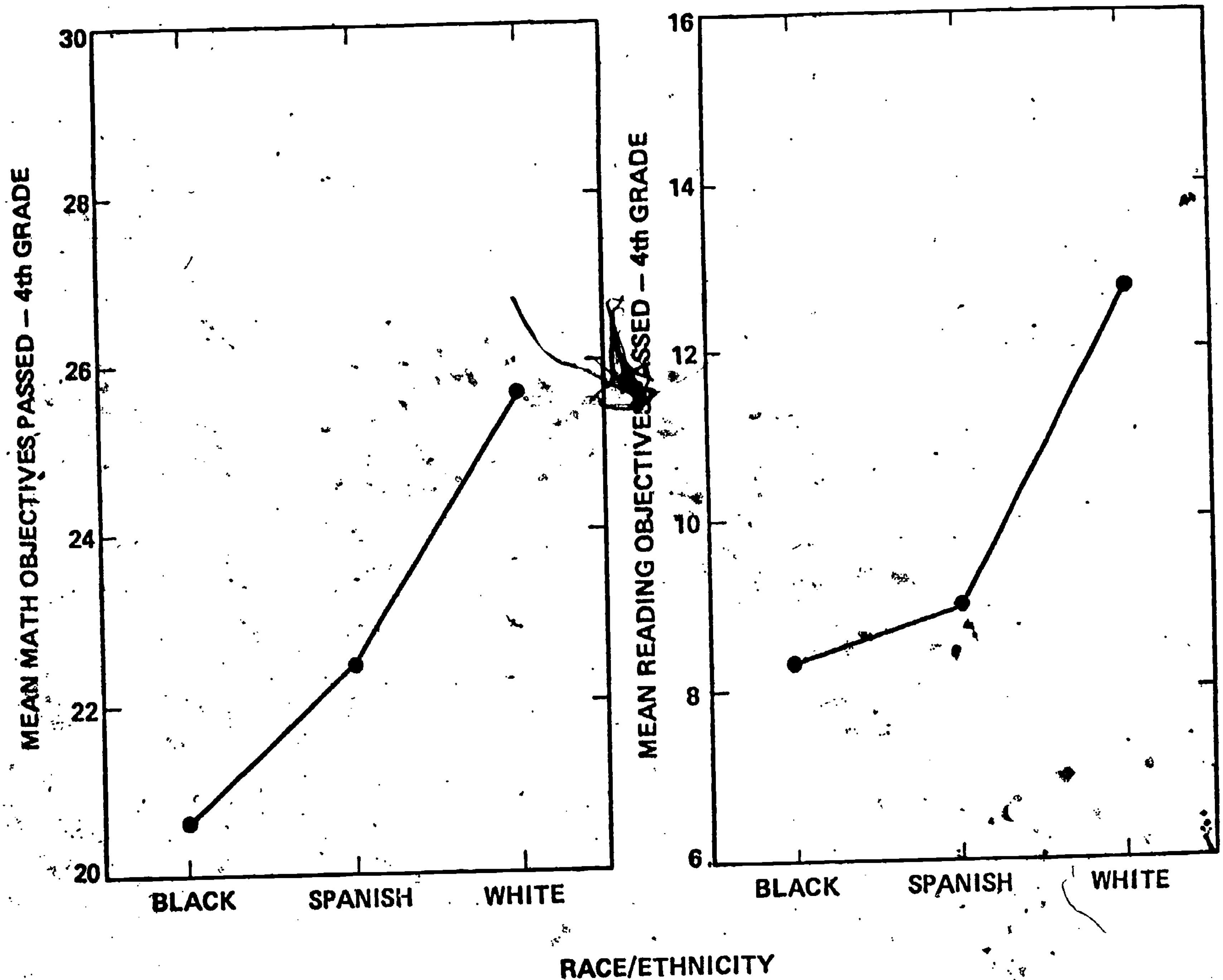

Figure 4. Mean performance of 4th grade pupils on the MEAP math. and reading tests, plotted as a function of race/ethnicity.

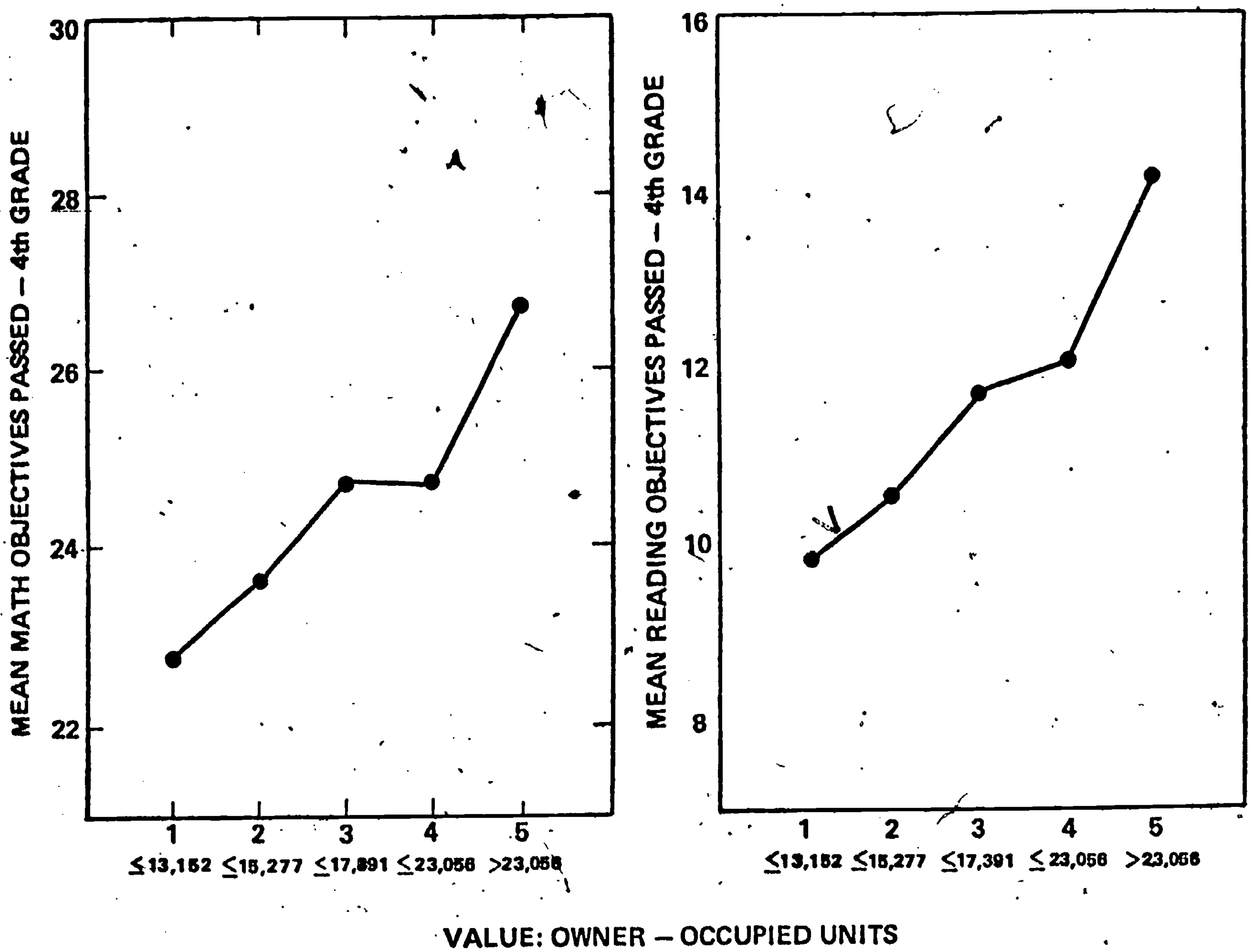

Figure 5. Mean performance of 4th grade pupils on the MEAP math and reading tests, plotted as a function of neighborhood lével, indexed by the value of owner-occupied units in the 1970 Census Third Count Summary.

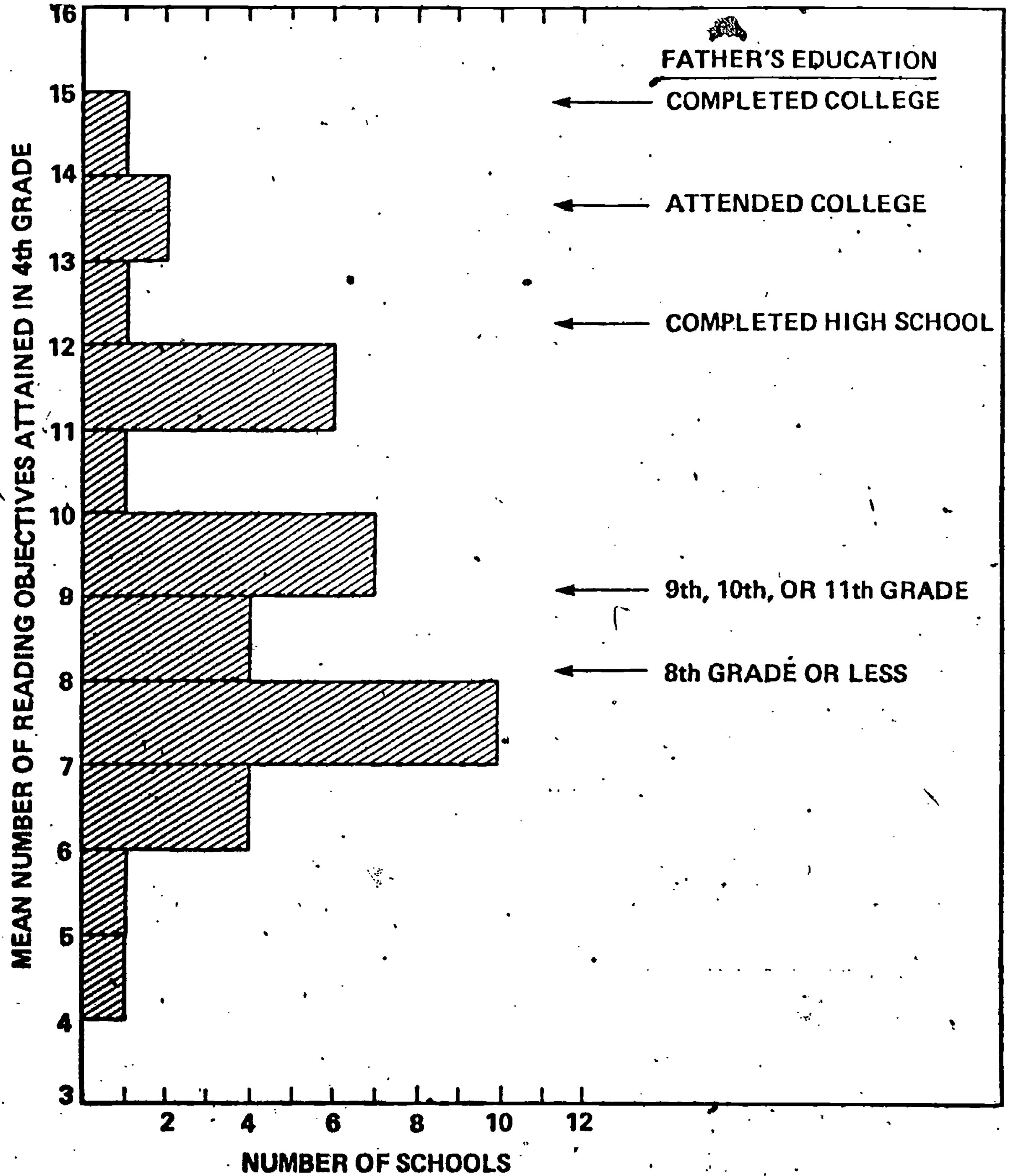

Figure 6. Frequency distribution of mean performance levels attained on the MEAP 4th grade reading test for those pupils whose parents have not finished high school. For reference purposes, typical performance levels for pupils from different educational backgrounds (indexed by father's education) are indicated at the right.

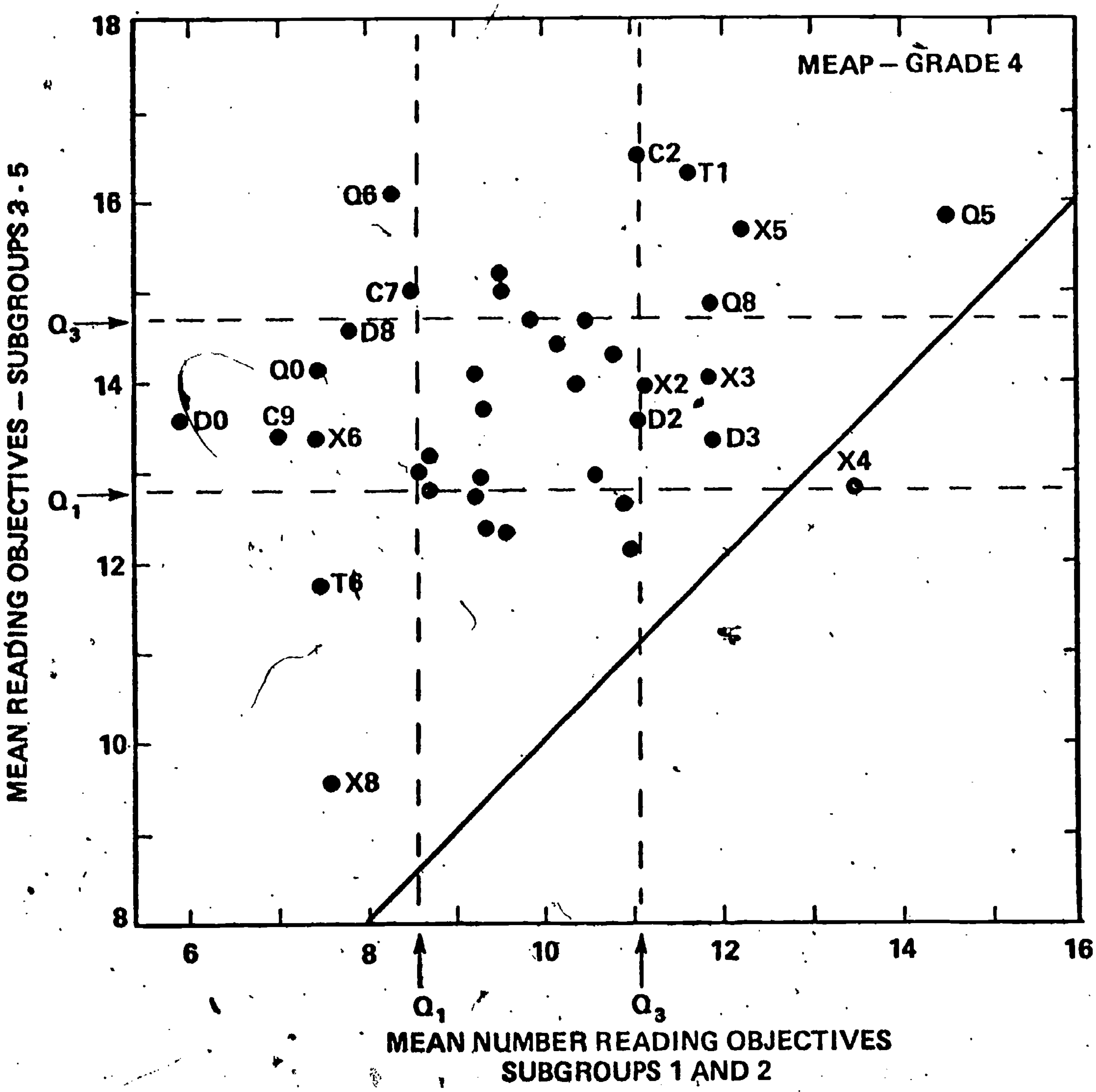

Figure 7. Mean levels of performance on the MEAP 4th grade reading test for each of 38 elementary schools. Performance levels for middle class children (subgroups 3-5) are plotted on the ordinate, and those for educationally less advantaged children (subgroups 1 & 2) on the abcissa.

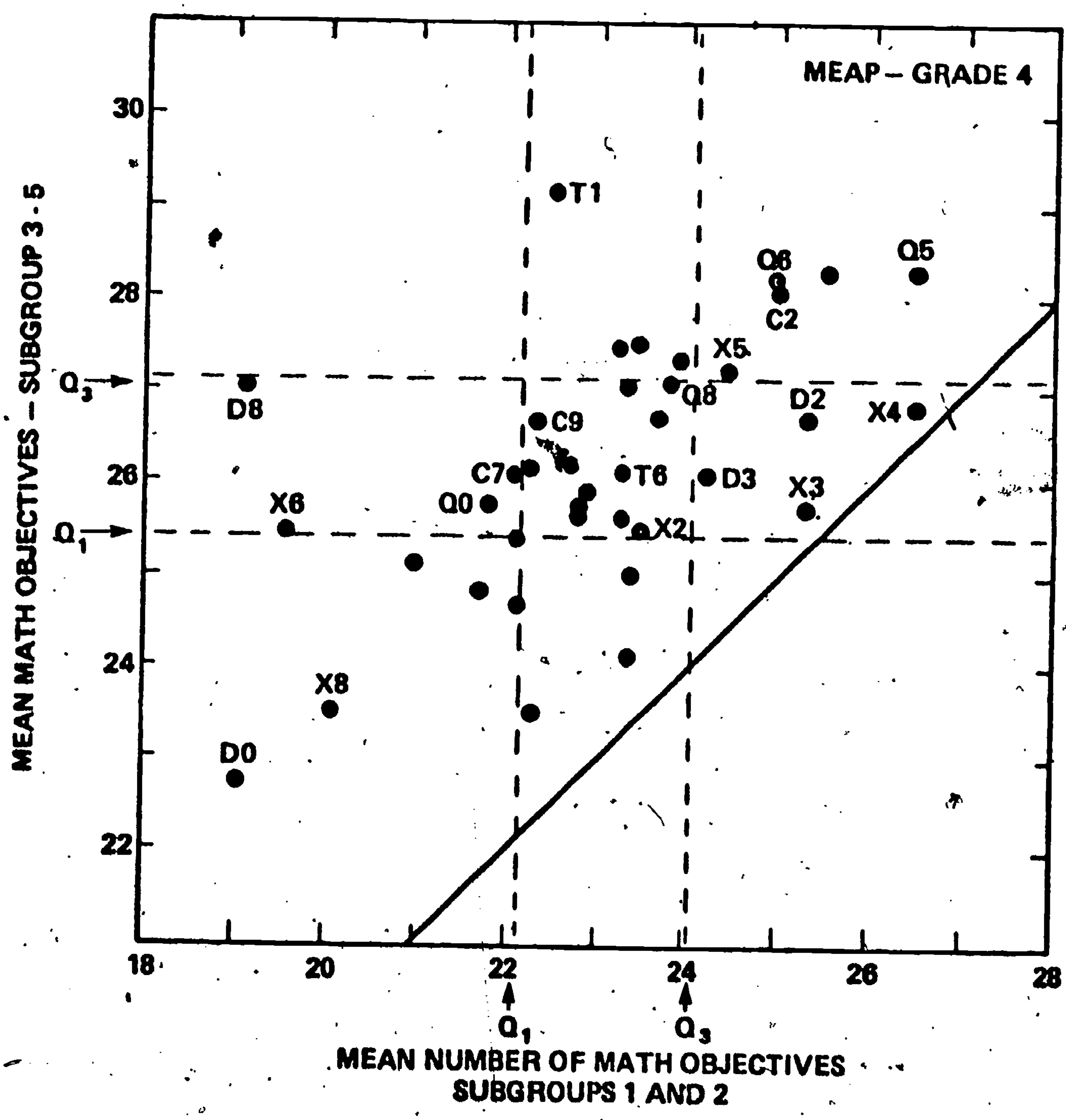

Figure 8. Mean levels of performance on the MEAP 4th grade math test for each of 38 elementary schools. Performance levels for middle class children (subgroups 3-5) are plotted on the ordinate, and those for educationally less advantaged children (subgroups 1 & 2) on the abcissa.

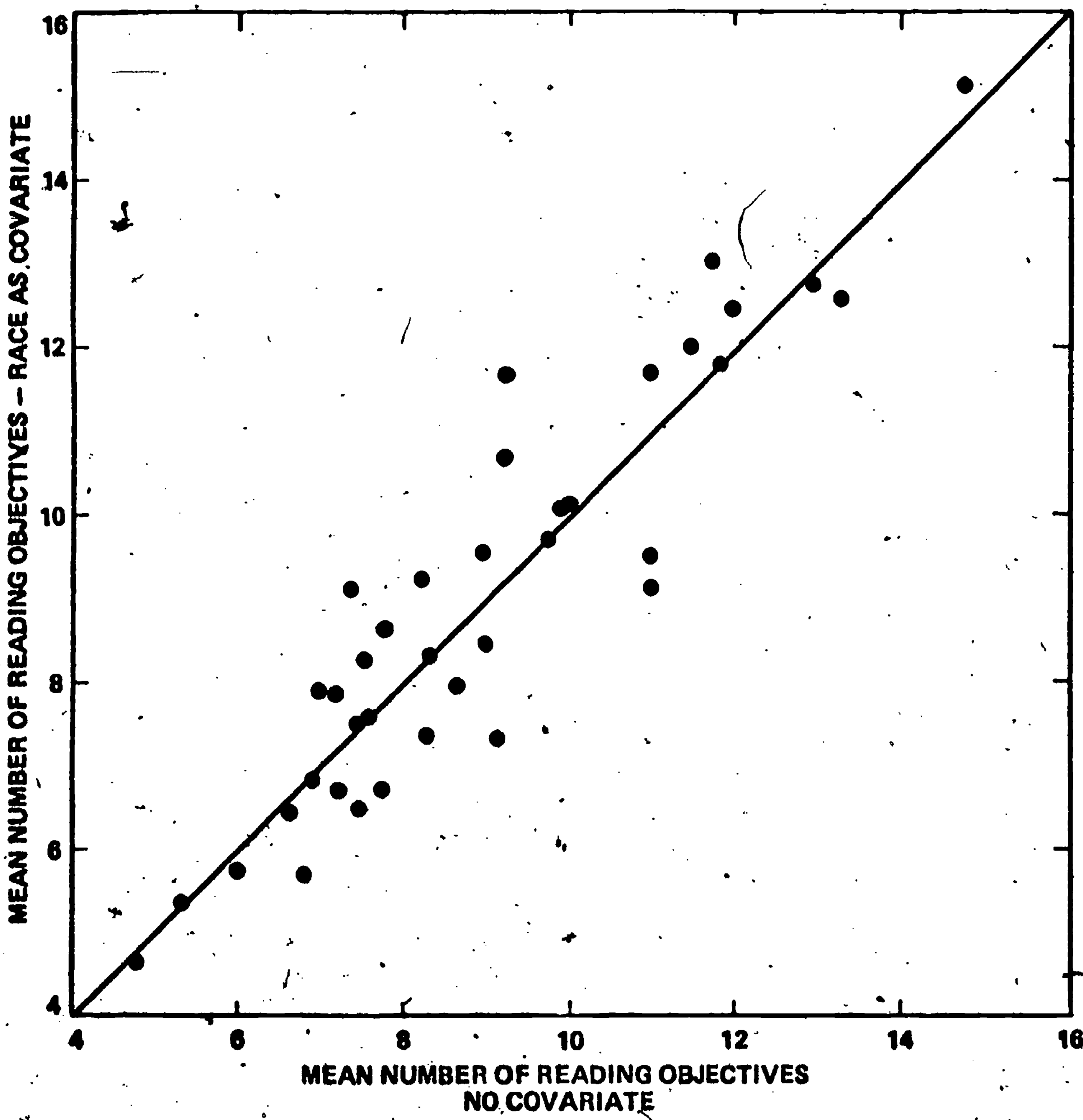

Figure 9. Mean number of 4th grade reading objectives passed for educationally disadvantaged pupils in each of 38 elementary schools, measured with and without a statistical adjustment for residual variations due to race.